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Journal of the Society of Arts.

FRIDAY, MAY 25, 1866.

Announcements by the Council.

ORDINARY MEETING.

Wednesday Evening, at Eight o'Clock:—

MAY 30.—"On Popular Errors concerning Australia." By the Hon. CHARLES GAVAN DUFFY.

CONVERSAZIONE.

The Council have arranged for a Conversazione on Wednesday evening, the 13th June, at the South Kensington Museum, cards for which will shortly be issued.

FIFTEENTH ANNUAL CONFERENCE.

The Fifteenth Annual Conference between the Council and the Representatives of the Institutions in Union and Local Boards will be held on Wednesday, the 13th June, at Twelve o'clock, noon. WILLIAM HAWES, Esq., Chairman of the Council, will preside.

Secretaries of Institutions and Local Boards are requested to send, as soon as possible, the names of the Representatives appointed to attend the Conference, and a copy of the last Report of each Institution should be forwarded, by book post, without delay.

The Council will lay before the Conference the Secretary's Report of the Proceedings of the Union for the past year, and the Results of the Examinations, as well as the Programme of Examinations for 1867.

The following suggestions of Subjects for Discussion have been received from various quarters, it being understood that in putting them forward the Council express no opinion whatever upon them:—

1. The scheme of Elementary Examinations:—Whether the Society of Arts should continue to furnish Elementary papers to Unions and Local Boards, or whether it would be better for the Society to confine its attention exclusively to the Final Examinations?

2. Presuming the outline of the present scheme to be retained, whether any modifications in the details should be made, such, for instance, as

   (*a.*) To substitute the terms First and Second Divisions for "Higher and Lower Grades," and to award first, second and third class Certificates to successful Candidates.

   (*b.*) So to arrange the time-table that the Examinations shall not clash with those of the Science and Art Department.

   (*c.*) That English Grammar be added to the list of optional subjects.

3. What means can be adopted to secure a greater number of Female Candidates at the Elementary Examinations?

4. Whether the great City Companies and other analogous bodies might not be invited to co-operate with the Society in promoting the Education of Adults by special prizes for competition in subjects with which such companies are officially concerned, or among Candidates connected therewith?

5. Whether the co-operation which already exists between this Society and the Royal Horticultural Society for the promotion of Education among Gardeners, might not be extended to other societies, with a view to the better promotion of Education among other classes of working men?

6. Whether cheaper Text books could not be in some cases recommended to Candidates at the Final Examinations, or whether any means could be adopted for enabling them to have ready access to the more expensive ones?

7. Whether it would be desirable for the Council to endeavour to interest the clergy, gentry, and others in country districts, in the Society's scheme of Examinations, by issuing an explanatory address, and directing attention to the existence of Local Educational Boards?

8. How far employers in London and other large towns can be induced to aid the Educational scheme, by giving to young men in their employ special encouragement to join the Institution Classes?

9. How can Institutions promote competition for the Prizes offered by the Society of Arts in Art-Workmanship?

10. The possibility of establishing Museums of a simple character, to circulate throughout the country, in connection with Institutions and Evening Schools, on the plan adopted by the Science and Art Department for Schools of Art.

11. By what means can the Society of Arts promote the erection of suitable buildings for the use of Literary and Mechanics' Institutes?

12. In what way can the Society of Arts aid Institutions in securing the services of gentlemen qualified to give popular Lectures on Scientific Subjects?

13. Can a Literary Institute be so conducted as to provide rational amusement and the means of mental improvement for the *various* classes of society? And, if so, what appliances are necessary for the successful working of such an Institute?

14. The promotion of athletic exercises, especially in the metropolis and other large towns, by establishing Gymnasia or otherwise.

Notice of any other subjects which Institutions or Local Boards may desire their Representatives to introduce to the notice of the Conference should be sent to the Secretary of the Society of Arts.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, on the evening of the same day (13th June), and will receive cards on application at the Society's House, on the day of the Conference.

CENTRAL HALL OF ARTS AND SCIENCES.

The arrangements for erecting a Great Central Hall of Arts and Sciences at Kensington, on the ground purchased out of the profits of the Exhibition of 1851, having been carried so far as to secure the erection of that building, it has been thought desirable that members of the Society of Arts should be put in possession of full information on the subject, in case they should desire to invest in the property, before the whole of the available seats are disposed of. A copy of the prospectus was, therefore, forwarded to each member with a former number of the *Journal*, and the Secretary of the Society will afford any further information on the subject if applied to.

Proceedings of the Society.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 23, 1866; William Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Adams, John, 391, Strand, W.C.
Calley, Samuel, Brixham, Devon.
Haines, Edmund Napoleon, Dartford, Kent; and Maidstone Wharf, Upper Thames-street, E.C.
Hirst, John, jun., Dobcross, near Manchester.
Lawson, William Thomas George, Freetown Cottage, Norfolk-road, Dalston, N.E.
Nairn, Michael B., St. Mary's Priory, Kirkcaldy, N.B.
Patrick, H. W., 18, Broad-street, Golden-square, W.
Rowett, William, 3, Adelphi-terrace, W.C.
Saunders, Thomas Harry, Dartford, Kent; and Maidstone Wharf, Upper Thames-street, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

Field, James R., 113, 114, and 115, Fore-street, E.C.
Ford, Gerard, 8, Lincoln's-inn-fields, W.C.
Gibbon, Richard, Royal Brewery, Brentford, W.
Lapworth, Alfred George, 9, Canterbury-villas, Maida-hill, W.
Swallow, John Charles, School of Art, York.
Thompson, Reginald Ward, 21, Kensington-square, W.

The Paper read was—

ON GRANITE WORKING.

By GEORGE W. MUIR, ESQ.

It is not my intention, in this paper, to attempt a scientific account of the origin, composition, and geological place of granite. It is intended chiefly to exhibit granite as it is in the rough, show what can be done with it by art, and tell you how and where it may be procured.

The districts in Scotland from which granite is chiefly obtained are Aberdeenshire, Argyleshire, Dumfrieshire, and the Stewartry of Kirkcudbright. In Aberdeenshire and Argyleshire the grey and red varieties are found, but in the south of Scotland the grey only, and that generally of a very light shade.

Although Aberdeen has acquired the reputation of being the source of the granite now so much used for architectural and monumental purposes, very little of the finer qualities can be had from the immediate neighbourhood of that city. The quarries from which the granites worked in Aberdeen are chiefly obtained are situated at distances varying from thirty to fifty miles to the north and west.

The red-coloured granite is quarried at Peterhead, 45 miles by rail to the north of Aberdeen, and the finest of the blue grey at Cairnegall, about seven miles south-west of Peterhead. A very fine black grey has also lately been found near Alford, on the line of rail from Aberdeen to that town. The old quarry of Rubislaw, near to Aberdeen, and from which the stone used in building one-half of the city has been obtained, supplies a granite which, when polished, exhibits a fine dark blue colour and well-marked grain. It has hitherto been a favourite for monumental purposes, but of late the quarry has been in a condition unfavourable for the production of pieces of a large size.

The granites of Argyleshire, and especially the red and pink varieties from the Island of Mull, are becoming favourites for all purposes, architectural and monumental. These fine granites are quarried on the west side of the Island of Mull, on the eastern side of the Sound of Iona. The Tormor quarry, from which the darker reds are taken, is within a mile of the venerable cathedral of Iona. The pink variety is got at North Bay, a few miles to the north of Tormor. These quarries are worked by the Scottish Granite Company (with which I am connected), and from them stones of any practical dimensions may be readily obtained at any time. Notwithstanding the great beauty of the colour and grain, and the large size of the stones which may be there obtained, the Mull granites are comparatively unknown in London. Mr. Gilbert Scott is the first architect who has appreciated their value and he has used them extensively in the beautiful memorial now rising in Hyde-park to the memory of the late Prince Consort.

Very fine granites are obtained in the south of Scotland. The quarries at Kirkmabreck, belonging to the Liverpool Dock Trustees, are among the finest in the kingdom, but they are almost altogether employed for engineering purposes, not being suitable for polishing, on account of the light colour. The granites best suited for polishing, for monumental purposes, are those in which the colour, when polished, is darker than when only fine axed or worked with the chisel. The Dumfriesshire granites do not rank high for this quality, and are not used except in combination with darker coloured stone. They are also very full of the ugly black spots which so disfigure a polished stone. From these spots, the Mull red and pink varieties are very free, compared with the red granite from Peterhead. A granite of somewhat better quality is had from Craignar, a wooded hill near Dalbeattie, a village about thirty miles eastward of the Liverpool quarries. From Craignar a considerable quantity of the stone used in the construction of the north side Thames embankment has been drawn. Nearly all the quarries in the kingdom have been drawn upon to supply stone for that great work, and considerable difficulty has been felt in meeting the demand. The Mull quarries supplied a portion previous to the erection of polishing works by the company. The product of the quarries is now consumed for the most part in the manufacture of monuments, columns, &c., for ornamental purposes.

It is remarkable that granite is obtained from places so few in number, and so far apart as Peterhead, Aberdeen, Iona, Dumfries, and Glasgow, but such is the fact. It is very difficult to get a supply of stone of good quality, and considerable expense has to be incurred, in the removal of superincumbent soil or worthless rock, before stone of a quality that can be profitably worked is obtained. The profitableness of a granite quarry depends in a great measure upon contiguity to a general market, where the smaller stone, resulting from the quarrying of large blocks, can be readily disposed of. In some quarries rubble is sold at the low rate of one shilling per ton weight; in others, where even that price cannot be got, it is thrown into the sea or into a waste heap. The quarries in Aberdeen derive a great portion of their profit from the sale of stone used in building there, and the manufacture of paving sets for the London market. The price or value of granite varies greatly; for while rubble is sold at a shilling per ton, ten shillings per cube foot, or one hundred and forty times the price of rubble, is cheerfully paid for a finer block.

In quarrying granite, or in the selection of a point in a mass of granite to be quarried, attention has to be paid to the lay of the rock. In the Cairngall quarry, belonging to the Messrs. Mac Donald, the stone lies from east to west. The east side of the hill is therefore that on which their quarry is situated. Another firm who opened a quarry on the same hill, but on the west side, had to abandon the working. The posts of granite, by which we mean the masses that stand separated from each other by dries or natural divisions, were the quarry worked on the side to which they incline, would fall upon the workmen engaged beneath them.

The forces employed in breaking the masses of rock into the dimensions desired are powder and the wedge. In using powder, a hole is "jumped" to the depth required, and being filled with powder and closed at top, it is fired with a fuse, timed to allow the workmen to retire to a safe distance.

The first shot generally does no more than shake the rock round the hole and make a number of cracks. The hole is again charged, and these cracks become filled with powder. The greater quantity of powder produces a greater effect, and the rock is further shaken and opened up. A third shot generally brings down the mass, and makes it available for the cutters to shape into blocks. This is done by wedging, or the "plug and feather," the latter being a short piece of steel inserted in a hole in the stone between two thin pieces of iron. By striking the plug with a heavy hammer the stone is split into pieces of the size desired. At the Kirkmabreck quarries no powder is ever used, but the stone lies in the most favourable position for detaching. It is desirable to use as little powder as possible, as otherwise the rock is frequently shattered in a way not intended, but it is not possible in every quarry to dispense entirely with its use.

No material is to be compared with granite for monumental purposes. Besides the beauty of the stone, it possesses the great recommendation of durability. Of what service is a monument of freestone, the inscription upon which will last possibly during the lifetime of those by whom it has been erected, and perish just at the time when it was expected to inform a succeeding generation of the virtues of the person whose memory it was intended to perpetuate? We frequently are employed to renew, in granite, tablets of freestone that have been fixed in church and churchyard walls, and which, from decay, can no longer serve the object for which they were originally designed.

Granite is now being very largely used for ornamental purposes in buildings, and I do not doubt that its use will very greatly increase, and that it will come to be used with greater skill and discrimination than it now is. The sameness of the colour of, say thirty, forty, or more columns on the front of a bank or other building, when all are of one colour, is not pleasing. Would it not be better to employ a variety of colours, or a variety of shades of the same colour?

Take any of the colours of the specimens now before you on the table. Let it be the dull, flesh-coloured red of Peterhead, or the livelier hues of Tormor from Mull; the light grey from Kirkmabreck, or the dark from Rubislaw; or even the unique and delicate pink from the north Bay of Mull, and it is impossible to come to any other conclusion than this, that the front of any building constructed wholly of any one of those colours will not be so beautiful as it would be if their varied colours had been judiciously combined. Great variety and beauty may be produced also by varying the style of work. Let the base be rough rock, the first courses above rustic, the next single-axed, and the highest fine-axed, and let their dull, solid surfaces be varied by polished columns, pilasters, lintels, and string-courses, and a building worthy of the greatest name in architecture, or the most honourable purposes to which any building can be applied, would be the result.

In selecting granite it is advisable to consider the purpose to which it has to be applied. The stone best suited for a monument or a column in a position where it can be closely inspected, may be of a finer grain than if it has to be placed at a higher elevation. I have seen buildings with very fine columns of grey granite so small in the grain, that at the distance from which they could be seen, the effect was no better than if they had been so many cylinders of zinc.

Apart from all commercial considerations, which may be suspected to influence one engaged in the granite trade, I should like to see granite used for the external front walls of buildings. Which company will be the first to have an office of which the front shall be wholly of polished granite? The cost would not be so great as may be supposed. The more extensively granite is employed the cheaper can it be supplied.

Granite may also with advantage be more largely used for interiors. A polished granite stair and staircase would be a very beautiful thing, and granite columns form a beautiful feature in a hall or corridor. By the combination of various colours a composition of great beauty can be produced.

It may be interesting to notice shortly the manner in which the stone is changed from the rough to the smoothly-polished surface. The form is given to the stone by the hands of skilled masons, in much the same way as is done with other stones of a softer nature. Of course the time required is considerably greater in the case of granite as compared with other stones. If the surface is not to be polished, but only fine-axed, as it is called, that is done by the use of a hammer composed of a number of slips of steel about a sixteenth of an inch thick, which are tightly bound together, the edges being placed on the same plane. With this tool the workman smooths the surface of the stone by a series of taps or blows, given at a right angle to the surface operated upon. By this means the marks of the single axe, by which the blows are given obliquely on the surface of the stone, are obliterated, and a smooth face produced.

Polishing is performed by rubbing, in the first place, with an iron tool, and with sand and water. Emery is next applied, then putty with flannel. All plain surfaces and mouldings can be done by machinery, but all carvings, or surfaces broken into small portions of various elevations, are done by the hands of the patient hand polishers. The operation of sawing a block of granite into slabs for panels, tables, or chimney-pieces, is a very slow process, the rate of progress being about half an inch per day of ten hours.

I have brought some specimens of stone in the polished and rough state, and a few of the lighter tools used by the workmen. The idea did occur to me to have a workman engaged in some of the operations brought before you, but on consideration the execution of that idea has been deferred until the next great industrial exhibition is held, when the whole operations, manual and mechanical, may be exhibited on a normal scale.

The machines employed are few and simple. They are technically called lathes, waggons, and pendulums or rubbers. The lathes are employed for the polishing of columns; the waggons for flat surfaces, and the pendulums for mouldings and such flat work as is not suitable for the waggons. In the lathes the column is placed and supported at each end by points, upon which it revolves. On the upper surface of the column there are laid pieces of iron, segments of the circumference of the column. The weight of these pieces of iron lying upon the column and the constant supply by the lathe attendant of sand and water, emery, or putty, according to the state of finish to which the column has been brought, constitute the whole operation. While sand is used during the rougher stage of the process these irons are bare, but when using emery and putty, the surface of the iron next to the stone is covered with thick flannel.

The waggon is a carriage running upon rails in which the pieces of stone to be polished are fixed, having uppermost the surface to be operated on. Above this surface there are shafts placed perpendicularly, on the lower end of which are fixed rings of iron. These rings rest upon the stone, and when the shaft revolves these rings rub the surface of the stone. At the same time the waggon travels backward and forward upon the rails so as to expose the whole surface of the stone to the action of the ring.

The pendulum is a frame hung upon hinges from the roof of the workshop. To this frame are attached iron rods, moving in a horizontal direction. In the line upon which these rods move, and under them, the stone is firmly placed upon the floor. Pieces of iron are then loosely attached to the rods, and allowed to rest upon the surface of the stone. When the whole is set in motion, these irons are dragged backwards and forwards over the surface of the stone, and so it is polished. When polishing plain surfaces, such as the needle of an obelisk, the pieces of iron are of course flat, but when we have to polish a moulding we make an exact pattern of its form and have the irons cast from that pattern.

I have no caution to offer to a visitor to a polishing work but one, and that is, do not pass near to the end of the rod of a pendulum; for as it is pushed beyond the stone, and is not over half an inch in thickness, it is morally certain that if your body be in the way the rod will be pushed through it.

I have thus described the established modes of working granite. A Frenchman has lately introduced machinery by which he professes to work and polish granite by very much the same means as is used by mechanical engineers for the cutting and polishing of iron; but as yet, so far as is known to me, this new apparatus has not been found effective.

The demand for polished granite comes from all parts of the world. It is sent to every British colony, and to many parts of the continent of Europe. We are at present engaged in making a sarcophagus, intended to cover the body of one buried a thousand miles west of New York. This is, after all, not so very surprising, when I tell you that granite is carried to New York for a less charge per ton than if it were delivered in a midland county in England.

I need not inflict statistics on you, showing the rise and present extent of the polished granite trade. One fact will be enough:—Thirty years since, the late Mr. Macdonald had but four men in his employment, now his successors employ fifty times that number. I will not boast of the progress of the Scottish Granite Company, but we began a year since with an engine of six-horse power, and I hope soon to start another of thirty horse. I can also say that we are now engaged in polishing the heaviest columns ever made in Scotland. They will weigh about forty tons each, and I hope you will all live to see them on the new bridge at Blackfriars.

These columns we have been very reluctantly obliged to make in sections. This has arisen not from the quarries failing to produce blocks of sufficient size or our machinery being unable to handle them, but from the difficulty and risk of the transport from the polishing works to their intended position on the piers of the new bridge.

Now that the granites of the west of Scotland are becoming known and estimated at their proper value, and that Glasgow, the commercial metropolis of Scotland, with all the advantage of ready communication by sea and land, has entered into competition with Aberdeen in a line of business hitherto considered peculiar to the "granite city," the art of working granite will receive an impetus greater than any yet given, and this beautiful and most durable of materials will be applied to purposes for which it has not yet been considered suitable. To those of you now present who may purpose a visit to Scotland during the coming holidays, Glasgow offers a most convenient place for a visit to a granite polishing factory, and you may feel assured of full liberty to inspect the whole process.

I could not offer a view of a granite quarry in competition with a sight of the venerable ruins, monumental and ecclesiastic, of the distant Iona, but when there, if you will look across the narrow sound which separates Mull from Iona, you will see the ruddy knolls from which rock is being taken to be fashioned into things of beauty in architecture, and monuments to perpetuate the memory of domestic happiness, or the qualities of the statesman, the warrior, and the poet.

DISCUSSION.

Mr. Botley, in reference to the beautiful effects alluded to of polished granite of different colours for the pavement of entrance halls of private residences, inquired what would be about the cost of so paving a hall, say 10 feet wide and 20 feet long.

Mr. Muir replied, that would be a superficial area of 200 feet, and would cost from £120 to £130, or about 12s. 6d. per square foot. That would include slabs of various colours. A portion of the floor of Norwich Cathedral had been paved with polished granite, and the effect was very beautiful. The thickness of the granite made but little difference in expense, which would be the same whether the slabs were two inches thick or one foot, the cost being not so much in the material itself as in the cutting and polishing. The most practical thickness for pavement was 2½ to 3 inches. With regard to the alleged difficulty in the transport of large blocks, he might mention that the Scottish Granite Company had furnished four blocks for the Albert Memorial in Hyde-park weighing 60 tons each. On the subject of accidents from blasting in the quarries, they were not unfrequent, but for the most part they arose from want of due care on the part of the workmen themselves and a disregard of danger which was engendered by habit, much the same as in coal mines.

Mr. Campin gathered from the paper that the working of granite was essentially a manual process, and that labour-saving machinery had not been nor was capable of being introduced to any great extent into this operation. [Mr. Muir said, except for polishing.] He believed some twenty years ago machinery for the working of granite was proposed by a person named Hunter, with the view of saving labour in the primary operations, and he had hoped to have heard this evening whether any practical results had attended that attempt.

Mr. Muir replied that all the machinery yet invented for that purpose had failed.

Mr. Bishop regretted to hear that the granite columns for the new bridge at Blackfriars were intended to be made in sections. He had hoped that, in that instance, an opportunity would have been afforded of erecting monoliths which would bear comparison, to some extent, with those which were met with amongst the ancient remains of eastern grandeur. No doubt the practical difficulty in the way of monoliths was the great expense of transport. There were many large monoliths of polished granite met with in Egypt, amongst which the obelisk of Heliopolis was remarkable. That was supposed to have been floated down the Nile. He had also noticed some very large blocks of granite in the ruins of Baalbec. There were in particular three blocks in the walls of one of the ancient temples, placed at a height of about 20 feet each, which were about 64 feet long and 12 to 14 feet thick. We had nothing in this country to compare with these, and they must necessarily have been transported by land carriage. The quarry from which those blocks were obtained was situated about two miles from Baalbec, and there still remained there a similar block, almost ready for transport. The weight of this block was, of course, enormous, and it was lying some 12 or 14 feet below the surface of the surrounding country; but, if it were once raised, an almost level surface would be presented for its transport. But those blocks in the temple had been elevated 20 feet in the wall; if, therefore, the ancients were able to accomplish such a feat, with their rude mechanical appliances, there ought to be no difficulty in the management of monoliths in the present day.

Mr. Muir remarked that the difficulty of transport was solely of a financial nature, and this was the most troublesome one to be got over. It was proposed to bring from the Mull quarry a block, estimated at 700 tons, for the Albert memorial. That block was 150 feet long, without a crack, and he believed it to be solid to a depth of 15 feet; but the whole difficulty of transporting it to London consisted in the very great expense this would involve. It had even been suggested to take it to America for a memorial of Abraham Lincoln. In the case of the large blocks to which he had alluded as supplied for the Albert memorial, the cost of the crane alone for lifting them was about £650, and the whole mechanical arrangements were provided at a total cost of about £1,500. Therefore, unless the company had a succession of orders for these large blocks, they could not be supplied, except at a very high cost.

Mr. Street said, in reference to the more general application of granite for building purposes, it would be satisfactory to hear from Mr. Muir what was the cost of this material as compared with other stone. He presumed the great expense consisted in the dressing; and he apprehended it would have been a very costly affair to have constructed the façade of the Houses of Parliament in polished granite. He would be glad to hear what was the expense of dressed granite for building purposes as compared with other descriptions of stone.

Mr. Botley would add to that inquiry, whether the polishing rendered the granite more susceptible to atmospheric influences than when the surface was rough? It had been found that the small polished granite columns in Salisbury Cathedral had been subject to scaling, which was attributed to the high degree to which they were polished.

Mr. Muir replied that the result of twenty years' experience with granite—which was a very short time in connection with such a material—was that in the case of a granite obtained from one quarry in Aberdeenshire a certain amount of rust had taken place in that time, and a good deal of the original high polish had been lost, but nothing to which the word "scaling" could be justly applied had taken place. The decay of the granite in the Mull quarries was wholly inappreciable; the surface which had been exposed thousands of years was wholly undeteriorated. He believed the effect of polishing was in most cases to increase the durability of the stone, but any atmospheric action was more readily observable on a polished than on a rough surface. With regard to the cost of granite for building purposes, he believed it could be delivered in London at a price not exceeding that of some classes of Portland stone. Taking the case of a building with a frontage of forty feet and fifty feet high, which would comprise a superficial area of 2,000 feet, using tooled granite in the main portions, with polished lintels, columns, and architraves, the cost would be from £2,000 to £2,500. That was for stone of two feet thickness.

Professor Tennant having called attention to a paper on the "Art treatment of granitic surfaces," read by Mr. John Bell in the session of 1859-60,* which he said elicited a very valuable practical discussion, remarked that much might be said on the subject of granites—not only of the Scotch, but also the Cornish, the Devonshire, and the Irish granites; and he was happy to find the subject was now exciting the attention of the public; because it was a material which was undoubtedly capable of greatly extended application. A striking instance of this was afforded in the works of the Thames Embankment, in which several descriptions of granite had been employed, and there were others as well adapted for the purpose as those which had already been used. On a former occasion he alluded to that class of granites termed syenites, differing from the ordinary kind, which contained quartz, felspar, and mica, while syenite was composed of quartz, hornblende, and felspar. The latter was used by the Egyptians, and some beautiful specimens were to be seen in the British Museum. There were in the Museum of Oxford the finest illustrations of granites that could be met with anywhere, and Prof. Phillips had there shown the applicability of many of those varieties of granite which were little known at present. With regard to the so-called scaling of the surface of granite, he believed that to be due to the process of dressing. When the stone had been "starred" in the operation of tooling, and was afterwards exposed to the weather, the portion that was starred became liable to peel off. This was shown to be the case in one specimen of Egyptian granite in the British Museum, the arm of a figure, where it peeled off like the outer portions of an onion, showing where the axe or pick had bruised the stone in some cases to the extent of half an inch. In other instances the pressure of iron pyrites on the stone was a cause of decomposition; the oxide of iron expanded and burst the stone. In other cases there were large crystals of felspar, and in different granites these felspars varied in their composition. In one case there was potash felspar, and in another soda felspar. All these were points of great interest, and here was an opportunity of examining them in the different qualities of granite now being used in the works of the Thames embankment. In fact, he knew no city which better illustrated the varieties of granite than did the city of London at present.

Mr. Muir remarked that the starring to which Professor Tennant alluded was done prior to the polishing, and a slight starring might be taken off by the process of polishing. He believed the use of the new tool (described in his paper) which they could hardly suppose to have been employed by the Egyptians, would obviate the starring very much, as its effects were not produced by heavy blows upon the stone, but rather by oft-repeated gentle taps, which were not likely to produce starring. He should be glad to hear from Professor Tennant to what extent he considered the granite in the parapets of London-bridge, which had been erected forty years, had decayed from the starring.

Professor Tennant believed that the foot-pavement of London-bridge did not wear away to the extent of more than one-eighth of an inch in four years. With regard to the effect on the parapets he would refer to Waterloo-bridge, where the decay was very trifling indeed. About fifteen years ago an alarm was raised that the granite of Waterloo-bridge had decomposed to such an extent as to make the bridge unsafe, and the same was said about several other public buildings, but after a time those alarms subsided, and the structures were standing, and were likely to continue to do so. If they went back to the works of ancient art, the obelisk of Heliopolis, which had been erected 3,000 years, was still in good condition; and the same might be said of the obelisk brought over by Belzoni for Mr. Banks, at an expense of £2,000, and which had been erected in front of that gentleman's residence in Dorsetshire.

Mr. Muir said that as the paving-stones of London-bridge wore away only to the extent of one-eighth of an inch in four years, it was easy to estimate how slight would be the deterioration where the material was not exposed to any traffic at all.

Mr. Bishop mentioned the great amount of granite dust which was observable in the galleries of the Escurial, which no doubt fell from the walls, and was undoubtedly powdered granite.

Professor Tennant remarked that some qualities of granite decayed very much, especially some of the Cornish and Devonshire descriptions, from the decomposition of which had been produced the porcelain clay, or kaolin, which was so extensively used. The late Mr. Minton entertained the fallacious idea that the supply of that material would soon be exhausted; but there was no ground for this fear. This decay arose, he believed, from an excess of alkali in the granite, for when that was present beyond a certain amount, decomposition went on very rapidly. In the different granites there were two kinds of felspar: in fact, they had in granite four different ingredients; they had potash felspar in the white granite, and soda felspar in the red, with quartz and mica in addition. In the Scotch granite, and in that from Dartmoor, they had a form of tourmaline, which made it extremely brittle, and if it was employed for macadamising roads it was very soon reduced to dust.

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* *Journal*, vol. viii., page 281.

The Chairman would now ask the meeting to accord their thanks to Mr. Muir for the interesting paper he had read, which had led to so agreeable a discussion. There was great interest connected with the working of a material which had been supposed to be the earliest formation of which this world was composed, and when properly selected it was no doubt the most durable of all materials, but he was afraid the cost would preclude any very general use of it on the streets of London until cheaper modes of manipulation, by machinery or otherwise, were discovered. With regard to the natural decay of this stone, it was not necessary to say one word after the able remarks on that subject which had been made by Professor Tennant, but all travellers in Switzerland must have noticed the very rapid decomposition of the granite which went on, especially in the district of Chamounix. There could be no doubt that an enormous quantity of this *débris* was brought down from the upper granite formations by the action of the weather; but the surface over which this action took place was so large, that the extent of decay at any one point was very slight indeed. The light-coloured earthy masses that were brought down by the Aar and other rivers were in fact powdered granite. With regard to the cost of working granite for building purposes, as compared with other descriptions of stone, looking to the Houses of Parliament, he thought if the expense of facing that great structure had been double what it was, it might very possibly have been true economy; for that vast expenditure seemed likely to be wasted, inasmuch as the ornamental work was rapidly decaying. It was a melancholy fact that the material of many of our modern buildings was crumbling away even during the lives of those who had constructed them. Another interesting point was with reference to the starring. No doubt the theory of Professor Tennant on this subject was correct. If the starring was so deep as not to be removed by the after process of polishing, the effect would be apparent upon the column after a time, and that, no doubt, was the cause of the peeling which had been alluded to. Aberdeen had been referred to as the "granite city." It might have merits in the solidity of its granite houses, but it had the demerit of great monotony and coldness of colour, and the hardness of the material was such that there was not only monotony of colour but absence of ornamentation; so that, whatever other merits granite might possess, it could lay no claim to the promotion of florid ornament in architecture. He was quite sure the meeting would authorize him to convey to Mr. Muir their cordial thanks for the very interesting and practical paper with which he had favoured them.

The vote of thanks was then passed and acknowledged.

Proceedings of Institutions.

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Westminster Working Men's Club.—At the latter end of April a new building for this club was formally opened at an evening meeting. On the platform were Sir R. W. Carden, who took the chair until the arrival of the Earl of Shaftesbury; the Revs. Canon Conway, R. Malone, W. H. Turle, and J. Wright; Joseph Payne, Esq., and other friends; and the Working Men's Committee; there were also present Miss Adeline Cooper, the foundress of the Institution, and many other supporters. Mr. Edward Stephens, the secretary, read a statement of the general progress of the Institution. This first referred to the old building in Duck-lane, in which were started the Penny Bank, the Labour Loan Society, which, during four years and a-half, has lent in small sums to members nearly £900—honourably repaid. The Barrow Club, also, during the past three years, has enabled twenty-one members to become proprietors of their own barrows, instead of hiring them. There the Temperance Society sprang into existence. The various lectures, seventy-eight in number, which have been gratuitously delivered by kind friends, and generally profusely illustrated by diagrams, chemical experiments, models, or dissolving views, have brought forward a great variety of important subjects in a familiar shape. The educational classes have met the requirements of those members who desired to improve themselves, and these have been supplemented by the library, the newspapers, and magazines. The Bible-class and Sunday evening services have been well attended. A new society is in course of formation—the Co-operative Association—the store being situated at the corner of the building. It will be managed by the members of the club, who are holders of shares, which are 5s. each; it is proposed to sell good articles, give just weight, at moderate prices, and for ready money only, giving a bonus to all customers. In the club building there are on the ground floor a club-room thirty-two feet by twenty-four, and thirteen feet high, with a lavatory and other accommodation attached, also a kitchen and library. A portion of the club at the corner of Old Pye-street and St. Ann's-lane has been fitted up as a double-fronted shop, which forms the store just mentioned. Over the club-room is a lecture-room thirty two feet by twenty-four feet, a committee-room, and an office; the lecture-room may be divided into two by a movable partition, so as to form a reading-room and a class-room. Adjoining the club is a dwelling-house containing 60 tenements; the rents are to be about, for two rooms, 3s., for three rooms, 4s. 3d., for a single room, 1s. 9d., or a little more according to size; the rooms are 8ft. 6in. in height, a fire-place in every room, water, &c., on every landing. The cost of the ground, which is freehold, and the entire building, will be nearly £9,000; of this part is met by the compensation money for the lease and old clubhouse. The remainder, £7,600, is lent on mortgage, at 3 per cent., by the Marquis of Westminster, who has taken so generous an interest in the progress of this club. The rents have been made as low as possible, and it is only by the regular payment of those rents that all the incidental expenses and the interest can be met, and for which Miss Adeline Cooper and her co-trustees have made themselves responsible. The club is not self-supporting—the expenses last year were £95 6s. 3¾d.—there being a deficit at the closing of accounts of over £5. On hearing this Sir R. W. Carden at once sent a cheque to cover the deficiency. Addresses were delivered by Sir R. Carden, the Rev. Canon Conway, the Rev. R. Malone, the Rev. J. Wright. Mr. Williams, one of the working men, presented an address and a timepiece, subscribed for by the members of the club, to Mr. Stephens, their secretary, in acknowledgment of his services. The Earl of Shaftesbury, in his address, congratulated the members on their success, and dwelt on the advantages of intercourse between the different classes, which might be promoted in such institutions as this—the richer lending their friendly aid when needed, but the working men themselves retaining the management, and so maintaining a proper independence.

PARIS EXHIBITION OF 1867.

Meetings of the intending metropolitan exhibitors in classes 10, 11, 12, 13, 16 and 17, have taken place at the Society's house during the past week, and sub-committees have been appointed, who are engaged in dividing amongst the claimants the space placed at the disposal of each class.

In the French Ministers' report upon the Universal Exhibition, which it is proposed to hold in Paris in the year 1867, there occurs the following sentence:—"International Exhibitions promise to become perfect representations of modern society, in its various forms of activity." And an intention is announced of causing various historical reports to be compiled in France showing its present state of progress. In order that the principle thus set forth may be illustrated as far as England is concerned, the Committee of Council on Education have determined to exhibit, among other evidences of the "activity" of our civilisation, as far possible a complete collection of the periodical literature of the day, containing one specimen, which may be of any date in the year 1866, of each newspaper, review, literary, artistic, or scientific journal, magazine, tract, or pamphlet, play, &c., street ballad, and the like, published in the kingdom of Great Britain and Ireland, or in any of the British colonies, in the course of the year 1866. It is proposed to send this collection, when completed, to the Paris Exhibition of 1867, with the view of conveying to foreign nations some idea of the enormous amount of periodical literature for which there is a demand in England and its dependencies. It will be obvious to all those who may take the project which has been thus briefly set forth for consideration, that for the due carrying out of this object the co-operation of all those who are in any way concerned in the publication of periodical literature, in any one of its forms, will be indispensably necessary. All editors or proprietors of newspapers, therefore, whether such newspapers represent the metropolis itself, or any part or section of the metropolis—whether they be provincial or colonial newspapers, published in any town in England, Wales, Scotland, Ireland, or any of the British colonies; all proprietors of magazines, reviews, or other publications, whether annual, quarterly, monthly, weekly, or daily, as well as all secretaries of societies whose practice it is to issue tracts or pamphlets at regular intervals, and all dramatic writers, &c.; all such persons are requested to help forward this undertaking by sending to the Commissioners of the Paris Exhibition specimen numbers of each newspaper, magazine, review, tract, or pamphlet which they may be concerned in publishing, in order that every one of such specimens may be incorporated forthwith into the collection which is now in course of formation. The collection will be properly arranged and bound, and each contributor's name will appear in a report to be made on the collection by Mr. Charles Collins, who has been directed to superintend it. All communications in connection with matters treated of in this paper, as well as all specimen numbers of periodicals intended for exhibition, should be forwarded with as little delay as possible to the Secretary, Paris Exhibition of 1867, South Kensington Museum, W.—By order of the Lords of the Committee of Council on Education, Henry Cole, Secretary and Executive Commissioner.

JURY AWARDS, NEW ZEALAND EXHIBITION.

From the published reports of the jurors of this Exhibition, it appears that, under the resolution of the commissioners passed, "That medals or some other award of merit be granted to persons who have advanced the arts, industries and manufactures of New Zealand, by zealous services, or by sending articles to the Exhibition which do not fall under the awards of the juries, but which are of great merit," one gold medal, 75 silver medals, and 88 bronze medals were awarded. The gold medal was awarded to Alfred Eccles, Esq., Otago, the Hon. Secretary, as author of the plan of the Exhibition, and the chief instrument of its success. The following is a list of awards made for Great Britain, with the reasons for them:—*Silver Medals*—The Lords of the Committee of Council on Education for the excellent and instructive drawings executed by the pupils in the various Schools of Art under Government, exhibited by them; to J. Gould, London, for the valuable services rendered to the Natural History of New Zealand by his ornithological labours; to Dr. J. E. Gray, F.R.S., London, for the same reasons; to Mr. George Hewitt, Bradford, for his zealous services on behalf of the Exhibition; to Dr. J. D. Hooker, F.R.S., Kew, for the able and zealous services he has rendered to the colony, by his works on the botany of New Zealand; to the Right Hon. Sir Charles Wood, Bart., Her Majesty's Principal Secretary of State for India, for the numerous admirably arranged contributions to the Exhibition from the India Museum, London, illustrative of the products and manufactures of British India and its dependencies, very many of which were presented by the Secretary of State to the Commissioners for a local museum; to Dr. Lauder Lindsay, F.R.S.E., Perth, N. B., for his numerous and instructive exhibits and his interesting researches on the brown coals of Otago and the properties of the Tutu plant; to Mr. John Morrison, London, for his valuable services as agent for the Exhibition in Europe and America, and in recognition of his zeal in the service of New Zealand generally; to Prof. Richard Owen, D.C.L., F.R.S., &c., London, for the valuable services rendered to the Natural History of New Zealand, by his works on comparative anatomy, especially on the anatomy of the Moa; to Mr. P. L. Simmonds, London, in recognition of special services to the New Zealand Exhibition as sub-agent for Europe, his interesting exhibits, and his services generally towards the development of Colonial industrial resources; to Dr. J. Forbes Watson, London, for the excellent and instructive catalogue of the Indian exhibits prepared by him. *Bronze Medals*—To J. Arrowsmith, London, W. and A. K. Johnstone, Edinburgh, Dr. A. Petermann, London, and Mr. E. Stanford, London, for services rendered to the geography of New Zealand; to the Bradford Wool Association, and the Manchester Cotton Supply Association, for zeal in promoting the development of colonial industrial resources; to Joseph Craven, and to Messrs. John Foster and Son, Bradford, for their excellent manufactures from New Zealand wool; to John Lillywhite, London, as the only exhibitor of articles intended to assist in physical education, and their great excellence; to Marshall, Sons and Co., Gainsborough, for their very excellent portable steam engine for farm purposes; to Messrs. Francis Morton and Co., Liverpool, and Messrs. Phillips and Hill, Birmingham, for their extensive exhibits of galvanized iron fencing, particularly adapted for colonial use; to the Patent Plumbago Crucible Company, London, for their excellent Black Lead and other Crucibles, &c., suitable to gold smelting; to — Weston, Birmingham, for his excellent differential pulley blocks; to Professor Wheatstone, London, for the useful private telegraph invented by him; to Mr. W. Carr Young, London, for his services to the Exhibition. Besides the medals, 337 honorary certificates were awarded, of which 54 were to British exhibitors.

SPECIAL INSTRUCTION IN FRANCE.

With the exception of commercial reforms and extension, with which it is intimately allied, there is perhaps nothing which so peculiarly characterises the present age as the increase of the means of technical education; and France has done, and is still doing, more in this than any other country in the world. The struggle which is now going on for supremacy in industry and art, especially between England and France, renders this subject one of pre-eminent importance; the knowledge of what our neighbours are doing in such matters is therefore peculiarly interesting at the present moment.

The special schools which have existed for many years in France have, notwithstanding some defects and shortcomings, produced an immense supply of well-educated young men in all the arts, industrial as well as ornamental; and the means which have been taken of late years for the improvement of existing schools and the supplying of deficiencies are very remarkable.

Of the old establishments, the schools of theology, law, medicine, and science, the faculties of the University of Paris are the most important and best known. They are attended by a large number of youths, for in France the degree of Bachelor, and in some cases that of Doctor, is absolutely necessary, not only for professional pursuits, but for most of the superior ministerial establishments. Not to be a *Bachelier ès lettres* or *ès sciences* is, in Paris, not to be an educated man. A considerable number of foreign youths attend these colleges, attracted partly by their renown, and partly by the moderate amount of the fees.

There are other colleges, of more recent date, which are less known abroad. There is the *Ecole Impériale des Chartres*, connected with the *Palais des Archives de l'Empire*, which was reorganized in 1846, and which has for its object the teaching of archæology and palœography. This school has a very high reputation, and the officers who have the charge of the Imperial Archives in the various departments of France are chosen exclusively from amongst the young men who have passed through the school and obtained the diploma of *archiviste paleographe;* they have also the preference with respect to employment as professors in the school itself, as explorers and assistants in archæological pursuits, under the direction of the Academy of Inscriptions in the Institute of France, as keepers and assistants in the public libraries, and of the Imperial archives in the establishment already referred to—the *Palais des Archives* in Paris. This school, like the colleges, is under the authority of a director appointed by the Minister of Public Instruction. The courses of study are public and entirely gratuitous, but in order to obtain the diploma of the school, students must be inscribed on the lists, must have obtained the degree of Bachelor of Arts, and be under twenty-four years of age. A special library is provided to aid these inscribed pupils in their studies. Besides the director of the school, there are three professors and four assistant-professors, and its proceedings are watched over by a *Conseil de Perfectionnement*, of which the directors of the school, the keeper of the Imperial Archives, and the librarian of the *Bibliothèque Impériale* are members.

L'Ecole Normale Supérieure is one of the most important establishments in France; the scope of its studies is general, but it is a special college as regards the profession of education. As its name imports, it is for the instruction of teachers and professors; it prepares pupils for the licentiate, or intermediate degree between bachelor and doctor in letters and sciences; and the pupils who pass successful examinations become, at the conclusion of their course of study, teachers in the public schools or *lycées*. The chief conditions of admission to the *Ecole Normale* are:—Not being under eighteen or over twenty-four years of age; having obtained the degree of bachelor of letters or sciences; and an undertaking on the part of each pupil to devote himself for ten years to public instruction. The course of study occupies three years, and the pupils of the school attend the lectures of the faculties of science and *belles-lettres* at the College of France. The staff of professors and masters is very large, and includes such names as Nizard, Pasteur, Sainte Claire-Deville, and Briôt.

The *Collége Impérial de France*, founded, in 1530, by Francis I., and reorganised in 1774, is not a school or a college, in the strict sense of the term, but an establishment where lectures, free to all the world, are delivered by the first professors in France, nominated by the Emperor. There are no less than twenty-eight chairs, and amongst the present occupants of these are M. Julien Stanislaus, the famous Chinese scholar, who is also administrator of the college, MM. Regnault, the director of the works at Sèvres, Elie de Beaumont, Flourens, Coste, Alfred Maury, Léon Renier, Philarète Chasles, and Sainte Claire-Deville.

The *Ecole Supérieure de Pharmacie* receives as students those who hold diplomas as chemists and herbalists, and instructs them in all the sciences that in any way aid them in their business. This school was founded during the first empire, but was completely re-modelled in 1854.

The *Ecole d'Accouchements* deserves a few words. Here young women are instructed in the theory and practice of accouchements, vaccination, and blood-letting, and in the knowledge and use of herbs. The pupils are provided with board and lodging as well as instruction, on payment of six hundred francs a year, but no one is received for less than twelve months. A considerable number are sent to the school by the prefects and hospitals of the departments. Prizes are given to those who exhibit special aptitude.

At the *Jardin des Plantes* there are sixteen courses of lectures every season in the various divisions of natural history, and a school of drawing and painting from natural objects. The galleries of anatomy, anthropology, zoology, botany, mineralogy, and geology, as well as the botanical garden, the collections under glass and the library and menageries are open at all times to the pupils. The whole of the instruction given in this museum of natural history is gratuitous, and the professors include some of the first men of science in France, such as Chevreul, Flourens, Valenciennes, Becquerel, Milne Edwards, De Quartrefages, and Blanchard. There are sixteen professors and twenty naturalists on the establishment.

The whole of the above institutions are either directly or indirectly under the authority of the minister of public instruction. The following are in the province of the minister of the Beaux Arts:—

The museums and galleries of the Louvre, of the Luxembourg, and of Versailles are open five days a week for students, who require only a certificate from a professor, but there are no lectures or courses of study in these establishments.

The manufactory of china, enamelled ware, and painted glass at Sèvres, and those of tapestry and carpets at the Gobelins and at Beauvais, are in fact schools for art workmen in their specialities, as well as national establishments, which supply private producers with examples, and serve to maintain the high character of these productions.

The *Ecole Impériale et Spéciale des Beaux Arts*, established in 1863, is now under the Minister of the Fine Arts, and replaces the schools of drawing, painting, sculpture, engraving, and architecture, founded in 1648 and 1671, under the direction of the Academy of Fine Arts. The school includes eleven ateliers; three for painting, three for sculpture, three for architecture, two for engraving; and the professors are MM. Cabanel, Pils, Gerôme, painters; Dumont, Jouffroy, Guillaume, sculptors; Dufaux, Paccard and Laisné Charles, architects; and Dupont and Farrachon, engravers. Five of these gentlemen, as well as M. Robert Fleury, the director, are members of the Academy. There are regular courses of lectures given in the school on anatomy, mathematics, history and archæology, perspective, descriptive geometry, physics, chemistry, geology, and æsthetics and the history of art, by seven eminent professors. The instruction in this school is gratuitous, and the grand prizemen are sent to the Imperial Academy of France in Rome and the school at Athens, where they are maintained for a certain period at the cost of the state. There is an annual exhibition in Paris of the works sent home by the pupils. The number of pupils in the Ecole des Beaux Arts is only limited, we believe, by the amount of accommodation in the several ateliers. The class of M. Cabanel, who is very popular, contains at the present moment about eighty pupils. The works of the students who compete for the Grands Prix de Rome, in painting, sculpture, engraving, die-sinking, and architecture, are also publicly exhibited after the awards have been made.

The school of design and mathematics applied to the industrial arts is an establishment of the last century, having been founded by Louis XV., in 1766. Under the title of *Ecole Gratuite de Dessin* it includes classes for architecture, modelling, ornamental composition, study from the life, perspective, drawing from memory, engraving on wood, and all the elementary sciences upon which these arts depend. It includes day schools for the young and evening classes for adults, under the direction of an able staff of professors and assistants.

There are also two public schools of design for girls, under the direction of the same minister; of one of these Rosa Bonheur is honorary directress. The instruction in all these schools is gratuitous.

The last, largest, and best-known establishment in the Ministry of the Fine Arts is the *Conservatoire Impérial de Musique et de Déclamation*, presided over at present by the famous composer Auber, where more than six hundred pupils, male and female, are constantly under instruction for the lyrical and dramatic professions. There are no fees whatever charged for instruction, and twelve of the most promising scholars in the male vocal classes are supplied with board and lodging within the Conservatoire, wear a uniform, and have a box assigned to their use in each of the opera houses; an equal number of female scholars, who formerly were resident now receive an annual pension of eight hundred francs in lieu of board and lodging. An account of the Paris Conservatoire has already appeared in the *Journal*. There are in the provinces five, if not more, musical schools which are nominally, though not now practically, branches of the Conservatoire; that at Toulouse has a considerable reputation. Lille, Marseilles, Metz, and Nantes have each such a school.

There are singing schools for adults and for children attached to a large number of the municipal schools of France. The authorities of Paris have recently established singing classes for children in all but two of the arrondissements of the capital, and a large number of evening classes for adults are also held in the same establishment.

The Minister of Agriculture, Commerce, and Public Works has a number of establishments for special education in rural matters under his care, such as the Schools of Agriculture at Grignon, Grand Jouan, and La Saulsais; the farms and dairies at Haut-Tingry, Georottes, Corbon, and St. Angeau; and the veterinary schools of Alfort, Lyons, and Toulouse. Besides these there are several agricultural colonies, in some instances connected with the penitentiary system, and other establishments for instruction in agriculture, horticulture, and gardening, in various parts of the country. One, though not exclusively an educational establishment, and not under the minister in question, deserves notice, namely, the garden of the city of Paris, which supplies all the parks, squares, and other public places with flowers; seventy or eighty persons are employed in the establishment near the Bois de Boulogne, and these include about fifteen pupils.

The following are highly important establishments, under the direction of the minister last named. The *Conservatoire des Arts et Métiers*, which, besides its fine museum of machinery and models, includes a library of technical works and a large collection of designs of machinery and patent inventions, all open to the public; there are fourteen annual courses of lectures on the various branches of practical science, and a school of design and descriptive geometry for the gratuitous instruction of artisans, apprentices, and students. Amongst the professors of this establishment are Baron Charles Dupin, senator, General A. Morin, MM. Tresca, E. Becquerel, Payen, Persoz, and Wolowski.

Another technical school under the same ministry is the *Ecole Centrale des Arts et Métiers*, founded in 1829, and reorganised in 1857. The object of this school is the training of engineers for industrial pursuits and for the execution of public works. The course of study occupies three years, and foreigners are admitted on the same terms as natives of France. A portion of the scholars are supported by the Government, or by the departmental authorities, but admission is only to be obtained by competition at the annual examinations, and by youths who have attained the age of eighteen. The chemist and senator Dumas and other eminent scientific men form the council and body of professors. In connection with this establishment are three Schools of Arts and Manufactures, at Aix, Angers, and Châton. The pupils in each school number 300, and are nominated by the minister directly; nearly 700 are maintained wholly or partially by the state, the remainder pay an annual fee of £20. A scholarship and four three-quarter and half-scholarships are placed annually at the disposal of each department in France; and the Society for the Encouragement of National Industry has the disposal of six whole and two three-quarter scholarships.

The *Ecole des Ponts-et-Chaussées*, formed in 1747, and enlarged in 1851, has for its object the education of engineers for the public roads, rivers, bridges, and other works. The in-door pupils are taken exclusively from the *Ecole Polytechnique*, and rank as engineer students; but any person, French or foreign, properly qualified, may follow the courses of instruction in the school. The lectures are open to the public, and there is a museum of models, a library, and a laboratory for the use of the pupils. The *Ecole des Mines* is a similar establishment for the instruction of mining engineers. It was established in 1783, and enjoys a high reputation. Its pupils are of three classes—Pupils in engineering, taken from the Polytechnic School; out-of-door pupils, admitted after competition; and strangers nominated by the Minister of Commerce, on the application of the representatives of foreign powers. The whole of the instruction and maintenance in this school is gratuitous; the lectures and the gallery of minerals, which is one of the finest economic collections in existence, are open to the public. There is at Saint Etienne a school for miners; and at Alais another for the instruction of *maîtres-ouvriers mineurs*, or foremen of mines.

The *Ecole Polytechnique* although placed under the Minister of War, is not, like the School of St. Cyr, exclusively military. In this establishment, the cost for the two courses of instruction, including the necessary uniform and outfit, is about one hundred pounds. Admission is only to be obtained by natives of France between the ages of sixteen and twenty, with the exception of those in the army, who are admitted as late as twenty-five. There is a public examination each year, when the pupils who have completed their course of study are classified, and those who satisfy the requirements of the examination have the choice of an appointment in the artillery, either military or marine, in the corps of military, naval and hydrographic engineers, in public works, the gunpowder or tobacco manufactories of the state, or in the telegraphic establishments.

The municipality of Paris has also many schools for special instruction, amongst which are: the *Ecole Turgot*, for the education of youth intended for commercial and industrial pursuits; the *Ecole Supérieure de Commerce*, under the patronage of the state, and conducted by a council consisting of members of the Institute of France, councillors of state, bankers and merchants, under the presidency of the Minister of Commerce. Pupils are received between the ages of fifteen and twenty-five, and the payment for each pupil amounts to sixty or seventy pounds a year. A certain number of scholarships are however given by the government. The Municipal School of Design, founded in 1835, by a sculptor named Lequien, has three hundred pupils, from fifty to eighty of whom are maintained by the municipal authorities. The school of drawing and sculpture, conducted by the son of the same sculptor, educates sixty scholars gratuitously, while others pay half-a-crown a month. The *Ecole Commerciale*, founded by the Chamber of Commerce of Paris, with a drawing school attached, and a drawing school for girls, being one of the two already mentioned.

In addition to this long list of public, or partly public schools, the following new establishments for special instruction have either been recently founded or are now in course of establishment:—

A special central school for preparatory instruction in the practical departments of architecture has been started, with the countenance of the government and with the aid and subscriptions of Prince Napoleon, MM. Boitelle, Michel Chevalier, Péreire, E. Fould, Viollet le Duc, and other gentlemen. Its studies will include all the elements of architecture, both as an art and as a science, and its object is to prepare youths for the architectural classes of the Ecole des Beaux Arts.

The study of organic chemistry has recently been introduced for the first time into the regular college course, M. Marcellin Berthelot being appointed to fill the new chair thus established.

Another very important step has been taken by the Minister of Public Instruction, whose labours in the extension of education of all kinds are incessant; a special normal school is being established in the building of the old Benedictine Abbey at Cluny, which is situated in a fine agricultural district, and not far from the great manufacturing centres of Creusot, Lyons, and St. Etienne. The object of this college is to do for special what the central normal school of Paris does for general education, namely to create a corps of well-trained teachers, able to give instruction not only in the sciences but also in their practical application; and a large school is to be attached to the establishment, in which the pupil teachers may at once practice what they have themselves acquired. The school will be open to all comers, to be admitted, however, only on competition, the government supporting the pupils intended for teachers in the public schools, and the others to pay about thirty pounds a year.

The government has also recently established a school at Cluses, in Haute Savoie, for the training of lads intended for the watch and clock making trades, in order to improve the condition of that industry by the introduction of superior methods into the manufacture. The government has invited the authorities of the departments to contribute towards the expenses of the school, on account of the small means of the class for which it is intended.

A new Superior School of Commerce was founded in Paris a short time since, and is said to work well; the number of its scholars is not yet large, the diplomas granted during the last year and the number of medals awarded being, in each case, eight. Prince Napoleon gave a gold and a silver medal of honour, and the government furnished the rest. The scholars are principally from the departments, but the list of laureates included a Belgian, a Greek, and a Bulgarian.

The last item to be mentioned here, although at present only a scheme, deserves special notice. The new *Union Centrale des Beaux Arts* proposes to create an Industrial College on a grand scale. The original idea is attributed to M. Duruy, the Minister of Public Instruction, and the plan of the proposed establishment is the work of M. Guichard, the president of the society, who, moreover, has himself secured land for the building in the neighbourhood of the Faubourg St. Antoine, the great manufacturing quarter of Paris. The proposal is to unite all the means of industrial education, together with the collections and library of the Union itself, in one great collegiate establishment, large enough to accommodate several hundred pupils. The proposition is a bold one, and it is said that the means for carrying it into effect will not be wanting.

The above will give an idea of the large amount of special education and training provided in France; and, long as the list is, there are many other establishments in the provinces which are not included in it. It may be mentioned, by way of parenthesis, that an association for the promotion of professional training has just been formed at Nantes, and a Superior School of Commerce at Mulhouse. Looking at what has been done of late years in increasing and improving the means of instruction, it was not surprising to hear the Secretary of the Minister of Commerce declare at a public meeting, held in Paris some time since, that the Emperor had caused to be set on foot a most rigorous examination into the condition of professional instruction in France, of which the recent improvements and extensions are the result.

There may be doubts in many minds respecting the policy of making professional instruction too cheap, and thus drawing more young men from industrial pursuits than can find legitimate employment as artists or professors, but there can be no question about the fact of the extension of special training in France, and this is a subject which affects the artistic, industrial, and commercial interests of all the civilized world.

Manufactures.

Insurance of Boilers.—The engineer's report (for April) to the Manchester Association for the Prevention of Boiler Explosions, referring to three explosions that had taken place, says:—"There is yet an interesting fact with regard to the three explosions just reported which should not be passed over in silence. The three boilers had all been insured by a boiler insurance company, although, fortunately for the company, only one of the policies remained in force at the time of explosion, the other two having lapsed a short time previously. This, however, had been the act of the boiler owners, and not of the insurance company, who were willing to renew the policies. The first of these explosions arose from the weakness of the boiler at the unguarded manhole, and the second from wasting of the plates through corrosion, which would have been detected in time to prevent the explosion by a faithful flue examination, whereas no flue examination had been made during the whole of the four years the boiler was insured; while the third was due to the failure of one of the ring seams in a boiler of the dangerous plain cylindrical externally-fired class. The occurrence of these three explosions, resulting in the death of four persons and injury to seven others, as well as in considerable damage to property, will, it is thought, reopen a question already frequently asked, viz.:—Whether the application of insurance to boilers by commercial and competing companies is sound in principle and the best that could be adopted for the prevention of explosions? It is very generally supposed that a commercial company insuring boilers for the sake of dividends would inspect them for its own interests. This, however, is quite a mistake. Inspection is expensive. Insurance is cheap. Inspection, it has been found by the experience of this Association since its formation twelve years ago, costs upwards of 20s. per boiler per annum, while insurances could be effected, without any inspection at all, for about 2s. per cent. Internal and flue examinations, therefore, can only be enforced at the expense of profits; and a commercial company, with a proprietary looking for dividends, will clearly not expend 20s. to save 2s., but prefer to trade in insurances rather than inspections. In the event of explosion, insurance affords a poor compensation even for the loss of property, to say nothing of the loss of human life. The receipt of £100 or £200, according to the amount of the policy, is generally quite inadequate to cover the loss. In one case the whole works were laid in ruins; and in another, I am informed, £1,000 would not cover the damage done, although the insurance upon the boiler only amounted to £100. Insurance, therefore, affords the owner but meagre compensation for the loss of his property, and the workpeople none whatever for the loss of their lives. What the steam user needs for the security of his property, and the poor firemen and workpeople engaged near to boilers for the security of their lives, is inspection, not insurance; prevention, not compensation."

Brazilian International Exhibition.—There will be inaugurated in Rio Janeiro on the 19th of October, and continue open until the 2nd of December, 1866, an important agricultural and industrial exhibition. Manufacturers are cordially invited to render the exhibition more interesting by contributing to it the products of their intelligence, energy, and skilfulness. Arrangements have been made to place the requisite space at the disposal of foreign exhibitors. The following are the regulations for the special exhibition of engines, apparatus, and instruments constructed in foreign countries:—The engines or instruments participating in this special exhibition will not be entitled to premiums, and their exhibitors will be required to have them worked by their own mechanics during the days and at the hours set apart for that purpose. There will be furnished gratuitously to the exhibitors the necessary space, shafting, and steam-power. Engines requiring stone foundations or special constructions, and those already known and used in Brazil, will not be admitted. The exhibitors will be obliged to transport their engines to the exhibition building, and to put them in the places assigned to them at their own expense. After the close of the exhibition they can be sold, the regulation concerning the custom-house duties being complied with. Parties desirous of taking part in this exhibition should make known their intention to the ministers of Brazil in Europe and America, within the time specified for such purpose, together with a description of the engine about to be exhibited and its uses. All objects designed for this special exhibition and directed to the Executive Committee, will be received in the Custom-house and transported to the exhibition building without any duties being paid for them, a declaration of the contents having been made.

Commerce.

Coffee in Java.—A Ceylon planter, say Messrs. Travers, who has recently returned from a visit to Java, remarks in one of his letters that the Dutch Government appear to bestow more care on the opening of a coffee estate in Java than our planters do in Ceylon, for they clear the soil of all timber and roots, terrace the ground, and hole and plant with the utmost care, and with the best of nursery plants, but after that is done, no more trouble is taken. After planting artificial shade trees, and weeding three times a year, all cultivation seems to cease, and the crop then solely occupies attention. Government commands labour in Java, every able-bodied man being compelled to work seventy days out of the year for Government, and it is principally by this labour that the public works and the cultivation of the coffee plant is carried on—tobacco, sugar, and tea, being the only articles to which the arena of free agriculture has as yet been opened. When the coffee ripens on the trees, a certain number of men are ordered by the head-men to pick it, for which compulsory employment the coolie receives about fivepence a day; each labourer, helped by his women and children, picks from one to two piculs of cherry a day. This coffee they take home, pound and cure it there, and when finished, deliver it to the Government packing houses, where they receive twelve shillings per picul of one hundred and twenty-five pounds, five and a half piculs of cherry giving but one picul of clean berry. The chief reason why this peculiar mode of cultivating and curing coffee is adopted in this country is to be attributed to the fact that there is a very great scarcity of water, which is necessary for pulping and washing purposes.

Colonies.

Progress in Victoria.—The total extent of the national territory sold during the year 1864 was 260,169 acres, realising £522,601, or an average of two guineas per acre, and leaving actually unalienated an area of 49,734,251 acres. Of this quantity 30,463,999 acres are rented for pastoral pursuits in the form of 1,177 squatters' runs. About one-half of this number, namely 590, have purchased land attached to them, measuring nearly 3,000,000 acres. The agricultural statistics, on the other hand, show the total extent of land occupied to be 6,125,204 acres, of which nearly five millions are freehold, and the remainder rented. The actual extent of land under tillage is 479,463 acres, of which 125,040 acres were planted in wheat and 144,303 in oats, yielding respectively 1,899,378 and 2,694,415 bushels. Of other crops there were 3,594 acres planted with 8,750,408 vines, returning 110,042 gsllons of wine and 225 of brandy. Helping to cultivate this land, and deriving their sustenance from it, were more than nine millions of live stock, divided into 117,182 horses, 640,625 head of cattle, 113,530 pigs, and 8,406,234 sheep. Of these, 168,116, 29,667, and 532,857 respectively were killed to supply beef, pork, and mutton. There were also 74 breweries, employing 495 persons, and producing 6,179,712 gallons of beer.

Coal in Queensland.—The coal mining industry, though one of but recent birth, gives promise to become one of the most important in Queensland. The Red Bank coal mines were, until a few months ago, the only ones in existence, and it is only lately that they have been worked upon an extensive scale. The Burrum mines beyond Maryland, discovered a short time ago, are reported to furnish an excellent specimen of coal. The ships which visit this and other parts of Queensland would be glad to take away coal instead of ballast. The trading ships, also, from Victoria, South Australia, and Tasmania, would also avail themselves of a return cargo in the shape of coal.

Chinese Sheep.—Much attention has of late been given to the advantages that might accrue from the importation of Chinese sheep into Western Australia, and an encouraging report has been received, which may stir up those colonists who entertain a high opinion of the Chinese breed. These sheep are pronounced to be admirably adapted to the Australian grasses. The people of Victoria have taken the matter in hand, as well as the farmers of New South Wales, and are likely to carry it out with spirit. The sheep are large. and yield a heavy clip. They are said not to be subject to foot rot, and their increase is very great.

Notes.

The Origin of Petroleum.—In a lecture recently given by Professor Ansted, at the Royal Institution, "On the Mud Volcanoes of the Crimea," an attempt was made to show a connection between this peculiar form of volcanic action and the existence of petroleum, and the relationship of both to great lines of geological disturbance. In Sicily, during the commencement of the late eruption in the Bay of Santorin, a jet of muddy water at a high temperature was thrown out on the flanks of Etna, containing a slight quantity of petroleum, or naphtha. This was an instance of the outburst or first stage of the mud volcano. The great district of the Crimea, extending over 2,000 square miles, was next described, some of the mud volcanoes being of considerable age and of great size; one near Kertch, described by Strabo, and in eruption 70 years since, being a mile and a-half round at the base, and 250 feet high. Although no organic deposits were certainly known in the Crimea, the rocks were such as to indicate the likelihood of their existence. Those of Java were also noticed as running into connection with the same line as the petroleum springs of Rangoon. In Mexico and Trinidad the association was also pointed out; the same was the case in the Appennines, and on the flanks of the Alps were the famous asphalte beds of Seyssel. The lecturer considered the rock oils to be the result of slow volcanic distillation from beds of organic matter, and endeavoured to draw the inference that the particular conditions of the mud volcanoes should prove a clue to the presence in the subterranean rocks of petroleum.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 1. Annual Meeting.
Tues. ...Civil Engineers, 8. President's Annual Conversazione.
Royal Inst., 3. Prof. Ansted, "On the Application of Physical Geography and Geology to the Fine Arts."
Wed. ...Society of Arts, 8. The Hon. C. Gavan Duffy, "On Popular Errors concerning Australia."
Thur. ...Royal, 8½.
Antiquaries, 8½.
Royal Inst., 3. Prof. Huxley, "On Ethnology."
Philosophical Club, 6.
Fri ......Philological, 8.
Royal Inst., 8. Prof. Roscoe, "On Opalescence of the Atmosphere."
Archæological Inst., 4.
R. United Service Inst., 3. Mr. E. B. de Fonblanque, "Commissariat Operations during the Campaigns in China in 1860, and in New Zealand in 1864 and 1865."
Sat ......Royal Inst., 3. Prof. Huxley, "On Ethnology."

PARLIAMENTARY REPORTS.

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SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 14th May*, 1866.

137. Bills—Waterworks (amended).
149. „ Tramways (Ireland) Acts Amendment.
150. „ Local Government Supplemental (No. 2).
153. „ Poor Relief (Ireland) Law Amendment.
155. „ Sale of Land by Auction.
156. „ Salmon Fisheries (Scotland).
229. Turnpike Trusts Acts—Return.
235. Cattle Plague Inquiry—Quarterly Returns (Nos. 1 and 2).
236. Stockton-on Tees and Middlesborough County Courts—Return.
240. Hops—Return.
257. Diseased Cattle—Order in Council.
259. Population, Electors, &c.—Returns.
261. Helston Return—Return.

Delivered on 15th May, 1866.

153. Bills—Poor Relief (Ireland) Law Amendment (corrected copy).
157. „ Lunacy Acts (Scotland) Amendment (as amended on re-commitment).
158. „ Grand Juries Presentment (Ireland) (as amended on consideration of Bill, as amended).
206. Queen Anne's Bounty—Return.
223. Northallerton Election—Minutes of Evidence.
233. Harwich Election—Minutes of Evidence.
252. Government Property—Return.

Patents.

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From Commissioners of Patents' Journal, May 18th.

Grants of Provisional Protection.

Aerostatic apparatus—1143—J. W. Butler.
Agricultural produce, shaking, &c.—1072—J., J., and J. Hayes, jun.
Atmospheric railway breaks and communications—996—C. Kendall.
Bottles, packing—1313—J. Becker.
Carding engines—1217—J. Baron and E. Tattersall.
Carriages—1215—G. Davies.
Churns—1205—J. W. Hoffman.
Cigars and pipes, lighting—1301—W. Clark.
Coal gas, purifying—1116—J. Leigh.
Combs—1265—C. E. Brooman.
Confectionery—1231—O. R. Chase.
Cop tubes and shuttle skewers—1183—J. Strang.
Feeding apparatus—1213—R. R. Riches and C. J. Watts.
Fibres, combing—1123—W. Brookes.
Flax, rippling or seeding—1148—C. D. Abel.
Fountains—1193—J. W. Hoffmann.
Furnaces for preventing smoke—990—J. Chesters.
Gas—1156—G. F. Russell and W. H. Carbines.
Gas meters, dry—1239—D. Cohen.
Glass—1297—A. Pocheron.
Harness and saddlery—1249—C. Nurse.
Hides and skins for tanning, preparing—1271—C. de Caesaris.
Hollow projectiles—1221—W. Deakin and J. B. Johnson.
Hydraulic pressure, propelling ships by—530—H. S. Swift.
India-rubber, sheets of—1305—C. Moseley.
India-rubber, treating—1257—S. Bourne.
Iron—1263—A. T. Becks.
Iron and steel—1291—H. K. York.
Iron ships from corrosion, protecting—1195—J. B. Thompson.
Ladies dresses, supporting and extending the skirts of—1321—D. Gautier and A. Domeier.
Lamps and burners—1229—R. H. Hughes.
Lime kilns—1317—J. R. Swann.
Looms, pickers for—1241—J. and G. Shorrock.
Machinery, lubricating the spindles of—1281—J. Marsh.
Malt, treating—1235—F. Gritton.
Materials, compressing—1273—J. Walker and A. Warner.
Metallic oxides, reducing—1223—C. D. Abel.
Metals, obtaining—1255—C. W. Harrison.
Mineral and metallic substances with vegetable fibres and fabrics, combining—1177—G. Haseltine.
Minerals, cutting, &c.—1299—E. Fidler.
Penholders—1307—G. Seeley.
Photographic pictures, producing—1179—C. Hedler.
Photography—1315—W. B. Woodbury.
Printed articles, materials of—1153—R. Stackhouse.
Pulleys for casting, moulding—1191—T. Deakin.
Railway rolling stock—1267—W. E. Gedge.
Railway signals and points, actuating—1303—J. Brown.
Railways, draining, &c.—1175—J. Curtis.
Railways, working the switches or points on—1119—W. E. Newton.
Rolling mills—1225—J. Spencer and D. McCorkindale.
Rotary blowers—1333—W. E. Newton.
Rotary motion, converting reciprocating into—1277—G. T. Bousfield.
Sewing machines—1323—M. Henry.
Sewing needles—1331—H. Essex.
Ships' boats, lowering—1247—C. H. Ramsten.
Shoes, &c., lacing—1275—J. H. Johnson.
Smoke, consuming—1253—J. Botterill.
Smoke, preventing—1309—W. E. Gedge.
Soda from common salt, making—628—W. Weldon.
Spring mattresses—1169—H. A. Bonneville.
Springs—1289—H. Statham and B. Collins.
Steam boiler explosions, preventing—1197—E. Bray & J. C. Hargreaves.
Steam boilers—1227—G. Davies.
Steam boilers, preventing incrustation in—1251—G. Feasey.
Steam boilers, supplying water to—1181—T. Marshall.
Steam engines, expansion gear of—1293—J. Milner.
Substances, purification of—1171—S. Sequelin.
Targets for rifle ranges, mounting targets—1187—W. Soper.
Umbrellas—1245—W. Ince and W. H. Bedwell.
Vermin, destroying—1261—J. G. Hope.
Watches, &c., guards for—1128—J. Macintosh and W. Boggett.
Weaving, looms for—1237—H. Moore, T. Sagar, G. Keighley, and T. Richmond.
Window sashes—1211—C. A. B. Target.
Woven fabrics—1259—G. T. Bousfield.
Yarns—1189—P. Sanderson.

Inventions with Complete Specifications Filed.

Animal black or bone charcoal, cleansing—1366—G. A. Jasper.
Gun locks—1378—H. Grafton.
Ventilation—1384—G. Haseltine.

Patents Sealed.

3000. C. P. Coles.
3005. A. Lancefield.
3008. C. H. Chadburn.
3014. H. J. Cox and W. Loach.
3032. C. F. Whitworth.
3064. E. Farr and I. Gregory.
3093. T. A. Weston.
3168. H. A. Bonneville.
3184. N. W. Wheeler.
3233. T. R. Hetherington and S. Thornton.
3272. J. W. Carr.
3350. N. W. Wheeler.
3351. N. W. Wheeler.
3352. N. W. Wheeler.
191. A. F. Mineur.
300. W. R. Lake.
436. A. V. Newton.

From Commissioners of Patents' Journal, May 22nd.

Patents Sealed.

3015. G. W. Turner.
3017. C. Reader.
3020. S. C. Salter.
3029. J. F. Bennett.
3030. F. Trachsel and W. Hall.
3059. H. A. Dufrené.
3074. J. H. Johnson.

Patents on which the Stamp Duty of £50 has been Paid.

1220. B. Shillito and D. Moor.
1245. R. Fenner & W. H. Hight.
1248. C. Barnard, J. Bishop, C. Barnard, jun., and G. Barnard.
1231. R. Talbot.
1281. R. A. Brooman.
1282. W. Snell.
1284. T. A. Blakely.
1286. T. A. Blakely.
1326. F. W. and J. Kitson, jun.
1241. W. Watson.
1278. E. Sonstadt.
1340. H. Cartwright.
1420. J. G. Jones and R. Ridley.
1258. T. P. Salt.
1261. H. Wren and J. Hopkinson.
1262. J. Coignard.
1290. J. Higgins and T. S. Whitworth.
1307. W. Muir.

Patents on which the Stamp Duty of £100 has been paid.

1182. H. Clarke.
1242. R. Wilson.
1214. S. C. Sheard.
1331. O. Maggs.
1258. T. S. Cressey.
1231. E. Charlesworth.
1182. H. Clarke.